FCC Activities to Support 5G

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Federal Communications Commission

Workshop on 5G Technologies
For Tactical and First Responder Networks
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Note: The views expressed in this presentation are those of the author and may not necessarily represent the views of the Federal Communications Commission

Federal Communications Commission (FCC)

Mission

The FCC was established by the Communications Act of 1934 and is charged with regulating interstate and international communications by radio, television, wire, satellite and cable. The FCC's jurisdiction covers the 50 states, the District of Columbia, and U.S. possessions.

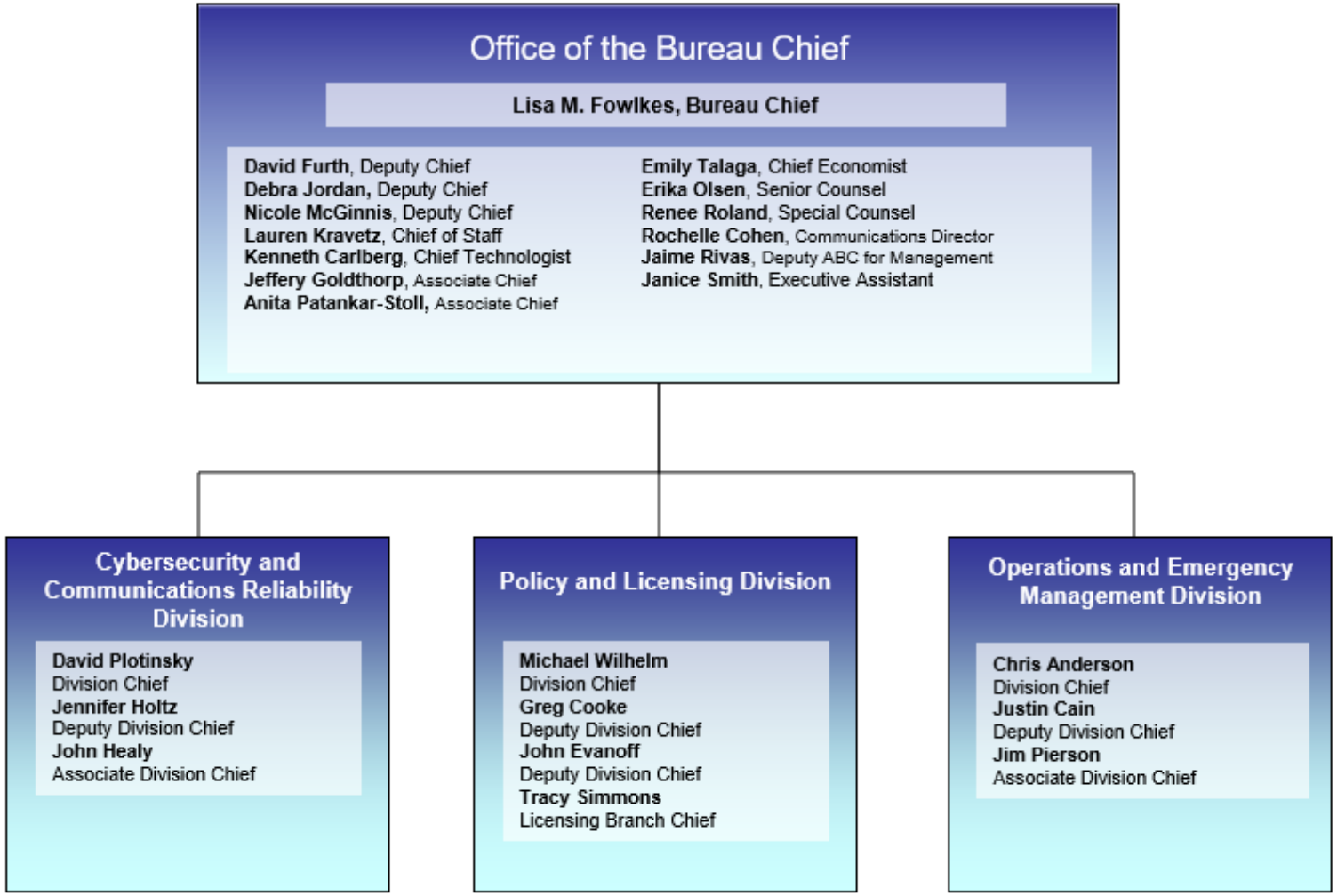
Commissioner Jessica Rosenworcel, Commissioner Michael O'Rielly, Chairman Ajit Pai and Commissioner Brendan Carr. *June 7, 2018*

Staff & Offices

- Staff of Approx. 1450 Attorneys, Economists, Engineers, et al
- HQ at 445 12th St, SW, Wash., DC
- Lab in Columbia, MD
- Field Offices

www.fcc.gov

Public Safety and Homeland Security Bureau

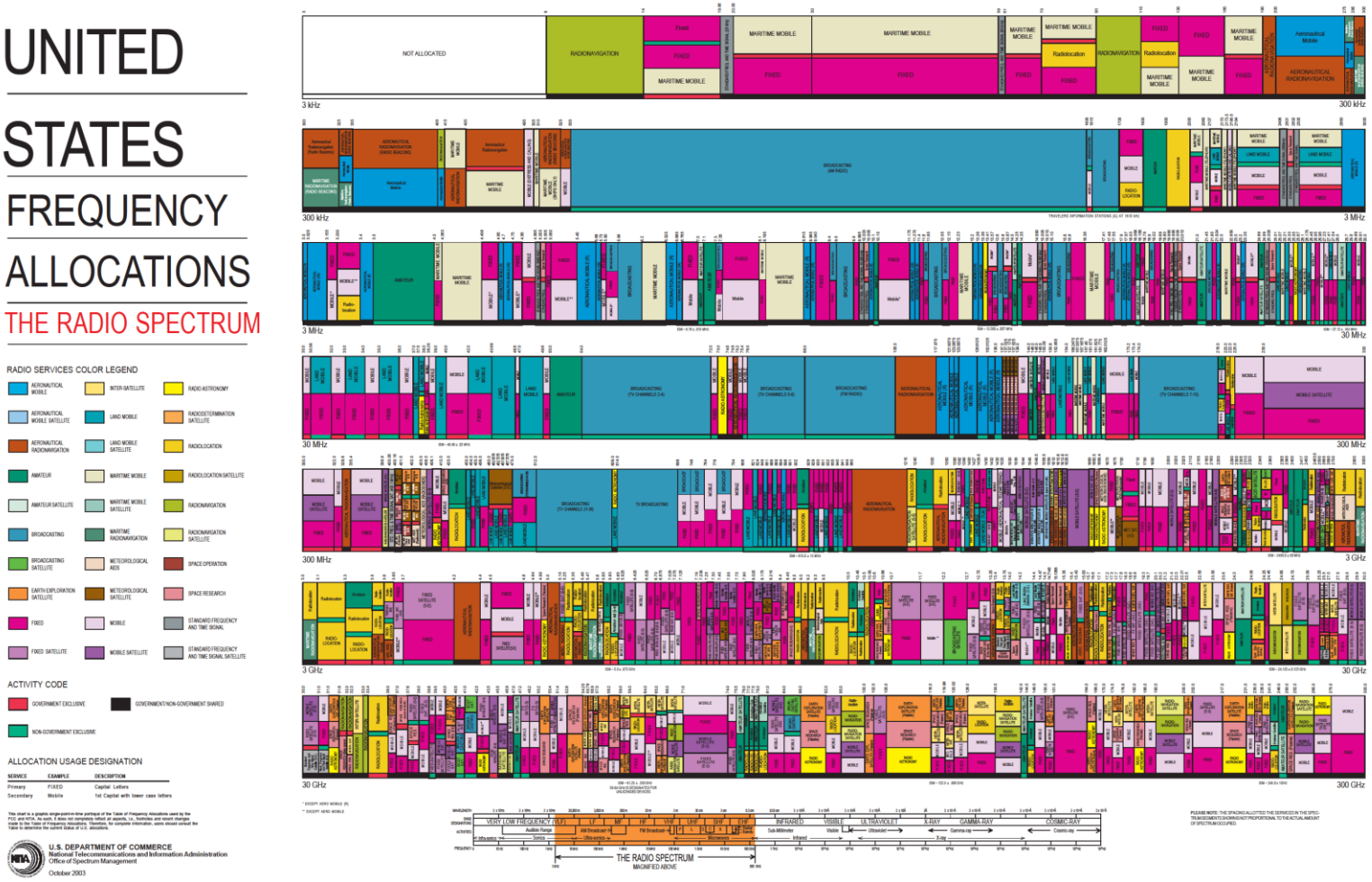


FCC Works Closely With Other Federal Agencies on Public Safety

FCC Jurisdiction on Spectrum

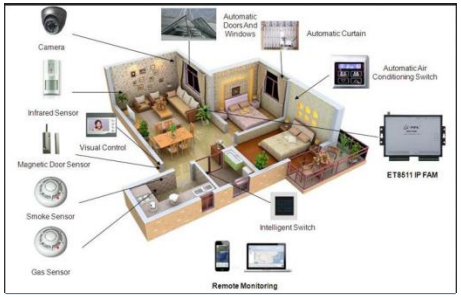
- FCC manages non-federal spectrum
- National Telecommunications & Information Administration (NTIA) manages federal spectrum
  - Advised by Interdepartmental Radio Advisory Committee (IRAC)
  - Federal Agencies participate in IRAC: FAA, DoT, DoD, NASA, DoE, State Dept., etc.
- Most spectrum is shared between federal and non-federal use
- FCC works closely with federal agencies

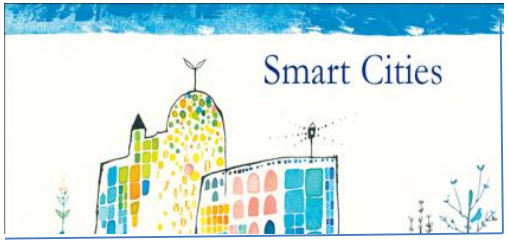
U.S. Spectrum Chart



The Everything Wireless World

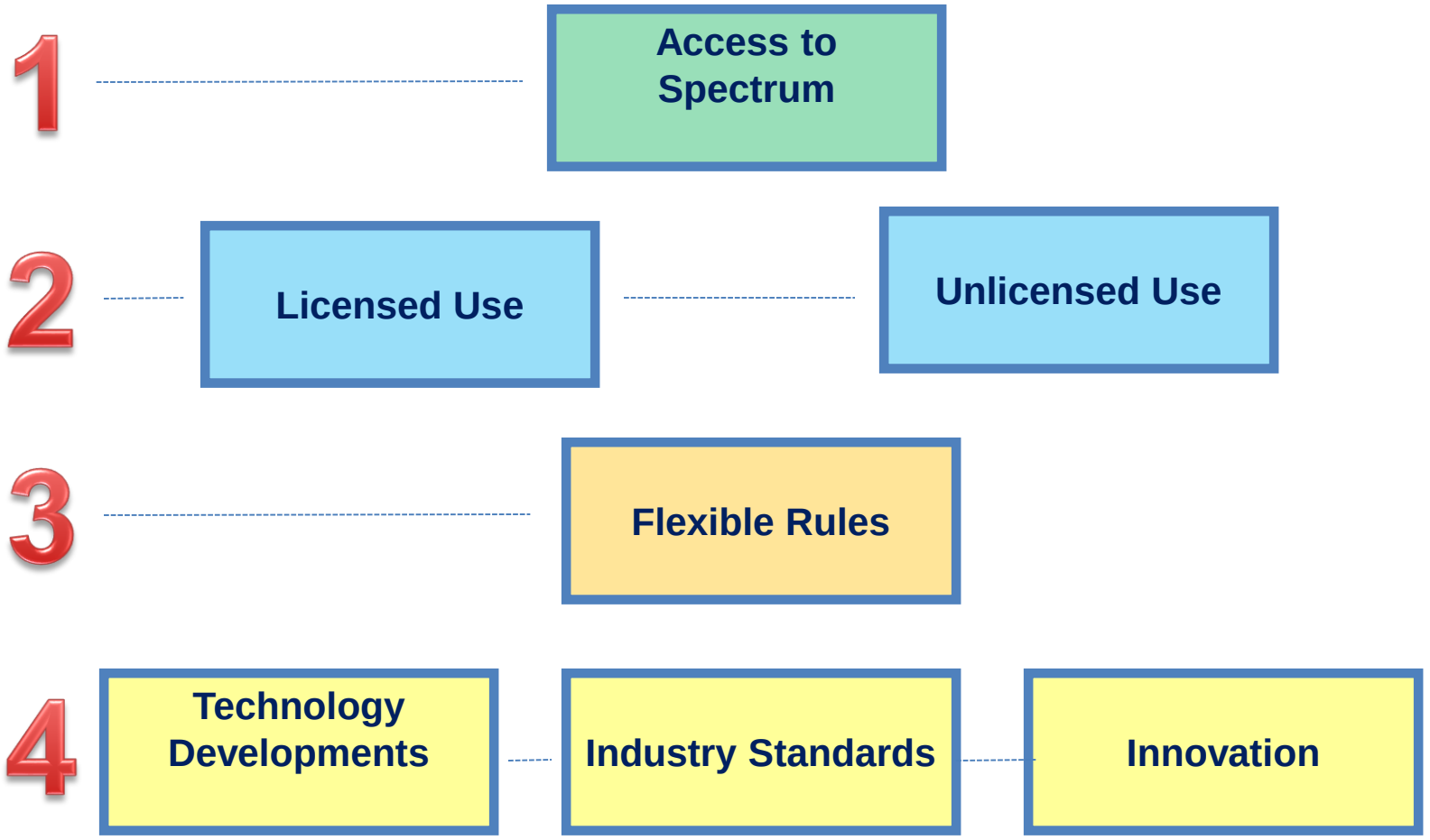
Demand for Access to Spectrum Continues to Grow





How This All Came About:

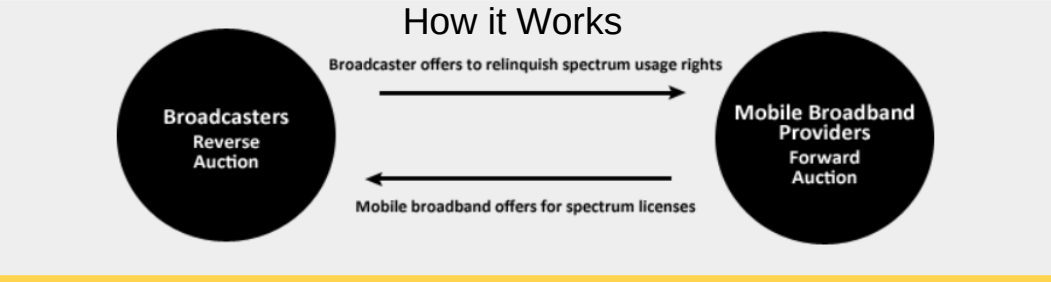
It's As Simple as 1, 2, 3 . . . 4

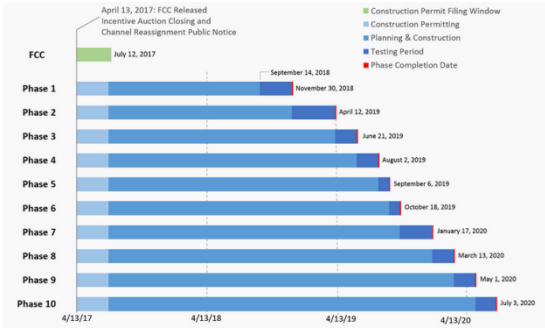


Key FCC Spectrum Initiatives & Proceedings

- **Low Frequency Spectrum:**
  - TV Broadcast Incentive Auction (600 MHz band)
- **Mid Frequency Spectrum:**
  - 3.5 GHz (3550-3700 MHz)
  - Proposal for 3700 – 4200 MHz
  - Draft proposal for 5925 – 7125 MHz
- **High Frequency Spectrum:**
  - Spectrum Frontiers (above 24 GHz)
  - Spectrum Horizons (above 95 GHz)

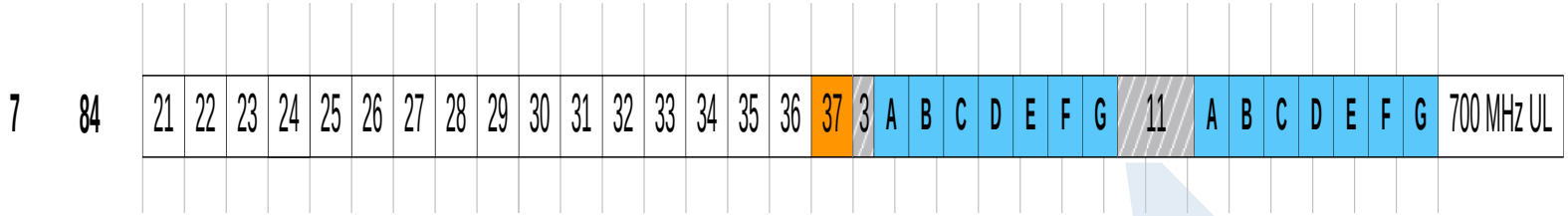
Low Band: TV Incentive Auction (600 MHz) band)



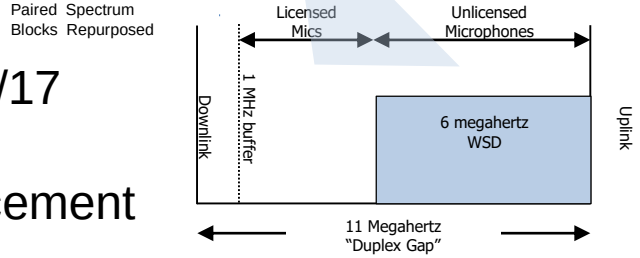


Ten Phase Transition Plan

- Reverse Auction
  - Ended January 13, 2017 – Stage 4; 84 megahertz clearing target

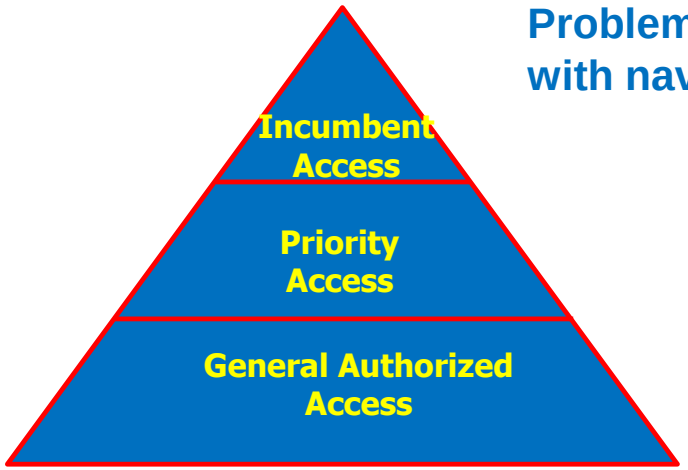


- Forward Auction Ended 2/10/17
- 39 month transition period began 4/13/17
- First licenses were issued 6/15/17
- Post-Incentive Auction Special Displacement Window 4/10/18 – 6/1/18



Mid Band
Citizen's Broadband Radio Service (3.5 GHz)

Problem: How to share spectrum (3550 – 3700 MHz) with navy radars other incumbent users



Spectrum sharing across three tiers

Spectrum Access System (SAS) protects against interference and manages access to spectrum

Dynamic Spectrum Access

Where We Are In The Process

- **Multi-stakeholder process -** WinnForum developing implementation
- **Conditionally approved first Spectrum Access Administrators**: Amdocs; Comsearch, CTIA, Federated Wireless, Google; Key Bridge; and Sony
- **SAS testing by NTIA** Institute for Telecommunications Science
- **Initial commercial deployments** - FCC soon to accept applications

Mid Band
3.7 & 6 GHz

- Proposed to make spectrum available in for licensed wireless service the 3.7 – 4.2 GHz C-band satellite DL band
- Planning to make proposals later this year for (unlicensed) access in the 6 – 8 GHz range
- **Significance**:
  - 3.7 GHz is adjacent to 3.5 GHz band and considered for 5G internationally
  - 6-8 GHz is close to 5 GHz unlicensed bands

Two Areas of Focus:

3.7 – 4.2 GHz – Licensed access to C-band satellite DL spectrum?

6 – 8 GHz – Unlicensed sharing with Pt-2-Pt microwave & satellite uplinks?

High Band Spectrum Frontiers

Spectrum Allocations

- 12.55 GHz of Spectrum added for mobile
  - **Licensed Bands (Total 3.85 GHz):** 24.25-24.45 GHz and 24.75-25.25 GHz; 47.2-48.2 GHz; 27.5-28.35 GHz; 37-38.6 GHz; 38.6-40 GHz;
  - **Unlicensed Bands (Total 7 GHz):** 64-71 GHz

Service Rules

- Part 30: Upper Microwave Flexible Use Service (UMFUS)
- Geographic Area Licensing, Area Size, Band Plan, License Term, Overlay Auctions
- Technical rules
- Performance Requirements

Often Associated with “5G”

Overview of First Report and Order Bands

	28 GHz	*37 GHz*	*39 GHz*	*64-71 GHz*
Frequency	27.5-28.35 GHz	37-38.6 GHz	38.6-40 GHz	64-71 GHz
Bandwidth	850 MHz	1600 MHz	1400 MHz	7000 MHz
Terrestrial Allocation	Licensed for fixed operations, with about 75% of the population covered by existing licenses; remaining licenses in inventory	Yes (no current use)	Licensed for fixed operations, with about 50% of the population covered by existing licenses; the remaining licenses are in inventory.	Yes (no current use)
Federal Allocation	No	Radio Astronomy / Space Research in 37-38 GHz @ 3 sites; Federal Fixed/Mobile in 37-38.6 GHz @ 14 locations	Fixed Satellite Service / Mobile Satellite Service in 39.5-40 (military use only)	Earth Exploration Satellite Fixed/Mobile/Satellite
Satellite Allocation	Yes	Yes (no current use)	Yes (no current use)	Yes (no current use)
Licensing Scheme	Licensed	Licensed	Licensed	Unlicensed

Satellite/terrestrial sharing accomplished by well defined protections & rights

Lower 600 MHz identified for sharing between Federal Government and Private Sector - - invited comment on sharing method

Overview of Second R&O Bands

	24 GHz	*47 GHz*
Frequency	24.25-24.45 GHz and 24.75-25.25 GHz	47.2-48.2 GHz
Bandwidth	700 MHz	1000 MHz
Terrestrial Allocation	Lower segment is licensed for two types of fixed operations: 24 GHz service and Digital Electronic Messaging Service (DEMS). 5 active 24 GHz licenses, and 38 active DEMS licenses; remaining licenses in inventory	Yes (no current use)
Federal Allocation	No	No
Satellite Allocation	Yes, 24.75-25.25 GHz band segment is non-Federal allocated for FSS (Earth-to-space)	Yes (no current use and the Commission designated this band for terrestrial use)
Licensing Scheme	Licensed	Licensed

Spectrum Horizons

- **Proposed to expand access above 95 GHz**
  - **Total of 102.2 GHz to for licensed point-to-point services**
    - Similar to 70/80/90 GHz rules
    - Licensed nationwide, non-exclusive basis
    - Register links with database manager
    - Seek comment on mobile use
  - **Total of 15.2 GHz for unlicensed use**
    - Similar to 60 GHz rules
    - Selected high absorption bands
  - **New type of experimental licenses > 95 GHz**
    - Longer license terms
    - Ability to sell devices

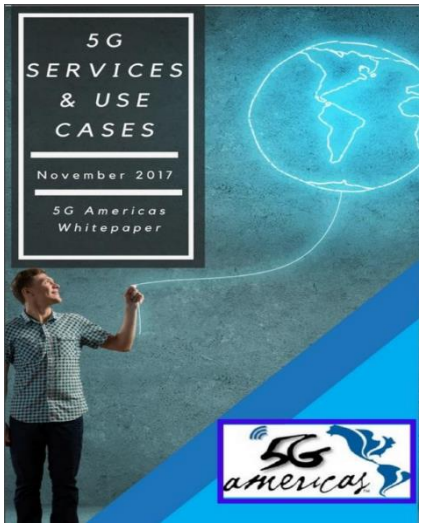
Much of the spectrum above 95 GHz is allocated for passive services

Achieve Fiber Capacity

Innovations

Five Things to Know About 5G

- 5G is not band-specific – (heterogenous networks)
- Much greater bandwidth & reduced latency
- Enables many new applications
- Near limitless applications
- Many predictions - - time will tell



http://www.5gamericas.org/en/resources/white-papers/

FCC Technological Advisory Council

- The FCC's Technological Advisory Council (TAC) provides technical advice to the FCC.

Topics for 2018

- 5G and IoT
- Mobile Device Theft Prevention
- Antenna Technology
- Communication Strategy for Drones
- Computational Power and Stress on the Networks

National Law Enforcement Museum Reflects Technology Evolution

Encourage you to visit!

Convergence of LMR & LTE

LTE Growth in Public Safety

There are a few reasons why LTE is making its move in public safety networks:

Standards Development – Mission critical communications LTE standards are developing quickly, with elements to meet the market needs being passed. Release 13, which was completed by the 3GPP in 2016, addressed the key issue of reduced latency, as well as enhancements to machine-type communications, and single cell point-to-multipoint. In 2017, Release 14 was approved and it further enhanced mission critical push-to-talk capability as well as mission critical data and mission critical video.

Data-intensive Requirements – Many public safety tasks require broadband services, such as when first responders need to access data-intensive applications, search databases, or share video or images. For example, an engine company is dispatched to a burning building. With an LTE network, the command center can send the fire fighters a floor plan, so they don't enter the burning building blind.

https://psc.apcointl.org/2018/09/04/hybrid-public-safety-networks-converging-lte-and-lmr-solution-for-evolving-mission-critical-comms/

5G For Tactical and First Responder Networks

From Today's Program:

Today, several standards organizations and forums, namely IEEE, 3GPP, and ITU, are working on defining the architecture and standardizing various aspects of 5G technologies. However, little has been studied to explore how 5G technologies can be useful to tactical and first responder networks. ***It is important to investigate how tactical and first responder communities can take advantage of 5G technologies to support massive bandwidth, massive sensing, and massive control type applications.***

A Word About 5G and The Internet of Things (IoT)

IoT Does Not Lend Itself to a Single Approach

Factors Affecting Requirements

- **Spectrum & Bandwidth:**
  - Video – high
  - Remote Control – It depends
- **Operating range:**
  - Short – Thermostat to AP
  - Long – Remote monitoring
- **Many other Characteristics:**
  - Device Size
  - Battery life
  - Required reliability
  - Antenna match

Many Ways to Connect

- **Wired**
- **Commercial wireless**
- **Satellite**
- **Other radio services**
- **Unlicensed**
- **Combinations of all the above**
- **And more**

The Internet of Things

FCC Technological Advisory Council

Graphic Courtesy Bill Morelli, IHS Technologies

Wired

- Ethernet, Coax, Fiber, etc. considered as a single category

WPAN

- ANT+
- Bluetooth – Classic & Smart Ready
- Bluetooth Smart

WLAN

- ZigBee PRO
- ZigBee RF4CE
- ZigBee Multi-Protocol
- EnOcean
- ISA100.11a
- WirelessHART
- Z-Wave
- Other 802.15.4

- 802.11a/b/g
- 802.11n
- 802.11ac
- 802.11ad
- Other 802.11
- DECT ULE
- Other 2.4GHz
- Other Sub-GHz

WWAN

- 2G Cellular
- 3G Cellular
- 4G Cellular
- 5G Cellular
- Satellite

Spectrum Available for IoT

Licensed

- Existing commercial wireless bands allow flexible use
- Expansion of spectrum:
  - AWS-3 – Auctioned 11/13/14
  - AWS-4 – Mobile Satellite S-band spectrum to terrestrial
  - TV Incentive Auction – 600 MHz
  - 3.5 GHz – Advanced sharing (Priority Access Licenses)
  - New licensed bands in millimeter wave spectrum at 24 GHz, 28 GHz, 37 GHz, 39 GHz and 47 GHz

Unlicensed

- Existing unlicensed bands allow flexible use:
  - 915 MHz (902 – 928 MHz)
  - 2.4 GHz (2400 – 2483 MHz)
  - 5 GHz (Total of 555 MHz)
  - 57 – 64 GHz (7 GHz)
  - Overlay in many other bands
- Expansion of unlicensed:
  - New band at 64 – 71 GHz
  - White Spaces in TV and 600 MHz bands
  - 3.5 GHz – Advanced sharing (General Authorized Access)
  - Relaxed existing 5 GHz rules
  - Considering additional spectrum at 5 GHz

Thank You!